

What is claimed is:

1. A resist lift-off process comprising:

covering at least a portion of a substrate surface with a photoresist;

depositing a dielectric layer on said substrate surface and said photoresist resulting in a sidewall dielectric layer being formed on a side of said photoresist; and

applying megasonic energy to said substrate surface via a thin meniscus of lift-off fluid to crack said sidewall dielectric layer.
2. The lift-off process of claim 1 further comprising adding a surfactant to said lift-off fluid to enhance wetting of said photoresist and said dielectric layer.
3. The lift-off process of claim 2 further comprising ultrasonically treating said substrate surface subsequent to applying said megasonic energy.
4. The lift-off process of claim 3 further comprising applying said megasonic energy a second time.
5. The lift-off process of claim 1 further comprising formulating said lift-off fluid to chemically react with said photoresist to initiate lift-off of the photoresist.
6. The lift-off process of claim 1 further comprising formulating said lift-off fluid to create repulsive Van der Waals forces between said photoresist and said substrate surface to effect separation therebetween.

7. The lift-off process of claim 6 further comprising controlling said repulsive Van der Waals forces by controlling a pH of said lift-off fluid.

8. The lift-off process of claim 7 further comprising formulating the lift-off fluid to oxidize said photoresist.

9. The lift-off process of claim 1 further comprising:
a metal feature provided intermediate said substrate surface and said photoresist; and
formulating said lift-off fluid to create repulsive Van der Waals forces between said photoresist and said metal feature.

10. The lift-off process of claim 1 further comprising reducing a thickness of said sidewall dielectric layer prior to applying said megasonic energy.

11. The lift-off process of claim 10 wherein said reducing a thickness of said sidewall dielectric layer further comprises performing low angle ion milling.

12. The lift-process of claim 1 wherein said applying megasonic energy further comprises pulsing said megasonic energy on and off.

13. An apparatus for applying megasonic energy to the surface of a substrate comprising a transducer fixture having a megasonic head assembly, said megasonic head assembly having a

plurality of megasonic transducer elements, each of said plurality of transducer elements individually operable in at least one of variable frequencies and variable power levels.

14. The apparatus of claim 13 further comprising:

a member adapted to hold a wafer parallel and in close proximity to said megasonic head assembly;

a thin meniscus of wave propagation fluid provided between said megasonic head assembly and surface of said wafer for application of megasonic energy to said surface.

15. The apparatus of claim 14 further comprising

a source of said wave propagation fluid in communication with said megasonic head assembly; and

said megasonic head assembly having at least one port therethrough for dispensing said wave propagation fluid to form said thin meniscus between said megasonic head assembly and said surface.

16. A resist lift-off process comprising:

covering at least a portion of a substrate surface with a photoresist;

depositing a dielectric layer on said substrate surface and said photoresist;

applying acoustic energy to said substrate surface via a lift-off fluid to facilitate lift-off of said photoresist; and

formulating said lift-off fluid to create repulsive Van der Waals forces between said photoresist and said substrate surface to effect separation therebetween.

17. The lift-off process of claim 16 further comprising controlling said repulsive Van der Waals forces by controlling a pH of said lift-off fluid.

18. The lift-off process of claim 17 wherein controlling said pH further comprises adding at least one of a base and a buffer solution to said lift-off fluid.

19. The lift-off process of claim 16 further comprising formulating said lift-off fluid to chemically react with said photoresist to initiate lift-off of the photoresist.

20. The lift-off process of claim 19 further comprising formulating the lift-off fluid to oxidize said photoresist.

21. The lift-off process of claim 16 further comprising adding a surfactant to said lift-off fluid to enhance wetting of said photoresist and said dielectric layer.

22. The lift-off process of claim 16 wherein applying said acoustic energy further comprises applying megasonic energy.

23. The lift-off process of claim 22 further comprising ultrasonicated said substrate surface subsequent to applying said megasonic energy.

24. The lift-off process of claim 23 further comprising applying said ultrasonic energy a second time.

25. The lift-off process of claim 16 further comprising:
providing a metal feature intermediate said substrate surface and said photoresist; and
formulating said lift-off fluid to create repulsive Van der Waals forces between said photoresist and said metal feature.

26. The lift-off process of claim 16 wherein said applying acoustic energy further comprises applying megasonic energy.

27. The lift-off process of claim 26 wherein:
said applying acoustic energy further comprises applying megasonic energy; and
said applying ultrasonic energy a second time further comprises applying megasonic energy a second time.